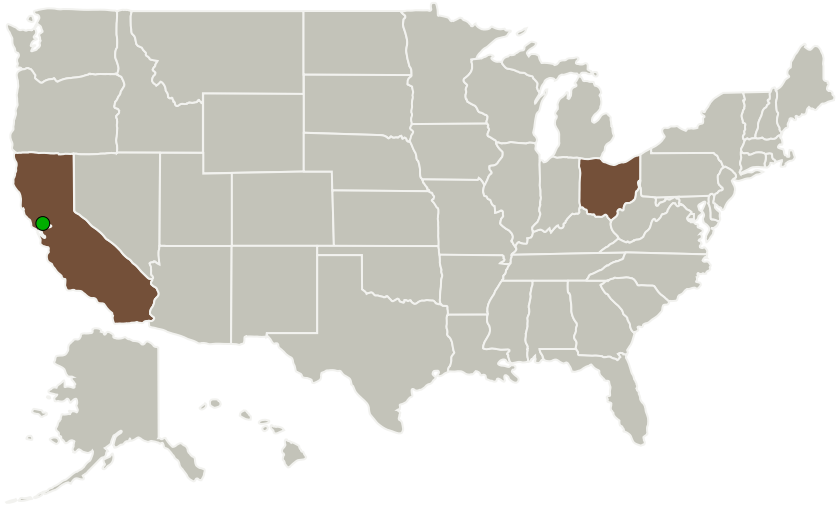
Fast Responding Pressure-Sensitive Paint for Large-Scale Wind Tunnel Testing, Phase I

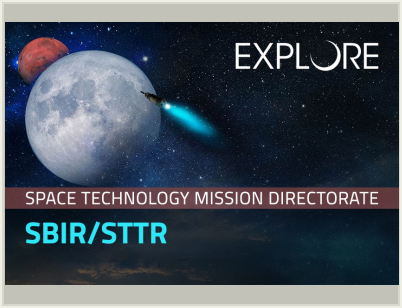
Completed Technology Project (2012 - 2012)

Project Introduction

The proposed work focuses on implementing fast-response pressure-sensitive paint for measurements of unsteady pressure in rotorcraft applications. Significant rotorcraft problems such as dynamic stall, rotor blade loads in forward flight, and blade-vortex interaction all have significant unsteady pressure oscillations that must be resolved in order to understand the underlying physics. Installation of pressure transducers is difficult and expensive on rotorcraft models, and the resulting data has limited spatial resolution. Application of a fast-responding pressure-sensitive paint should provide unsteady surface pressure distributed over the blade surface. Recently, fast PSP measurements have been demonstrated at NASA Langley on a 2-meter rotor model in hover and in forward flight by the ISSI/OSU team. This system interrogated the instantaneous pressure on the rotating blade at two azimuthal positions, an advancing and a retreating blade. We propose expanding this system for production testing in a larger wind tunnel, such as the Ames 80X120. This will be accomplished by adding remote control of the system interrogation region using remote focus/zoom/aperture lenses and pan/tilt stages combined with Ethernet hardware to control the systems remotely. The hardware will be packaged in modules to facilitate quick installation and removal. Remote control of the system will improve productivity during testing. Finally, the accuracy and resolution of the system will be characterized with bench top experiments that operate at distances similar to those encountered in the 80X120 and on rotating devices. These experiments include unsteady pressures in acoustic boxes and jets impinging on rotating disks.

Primary U.S. Work Locations and Key Partners





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Fast Responding Pressure-Sensitive Paint for Large-Scale Wind Tunnel Testing, Phase I

Completed Technology Project (2012 - 2012)

Organizations Performing Work	Role	Type	Location
Innovative Scientific Solutions, Inc.	Lead Organization	Industry	Dayton, Ohio
Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California

Primary U.S. Work Locations	
California	Ohio

Project Transitions

February 2012: Project Start

August 2012: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/138077)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Innovative Scientific Solutions, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Jim Crafton

Co-Investigator:

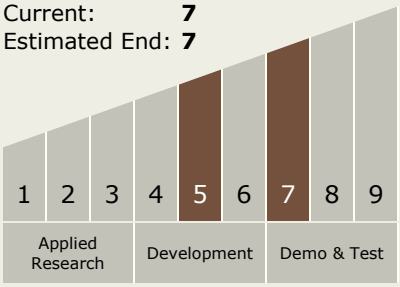
James Crafton

Fast Responding Pressure-Sensitive Paint for Large-Scale Wind Tunnel Testing, Phase I

Completed Technology Project (2012 - 2012)

Technology Maturity (TRL)

Start: **5**
Current: **7**
Estimated End: **7**



Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.3 In-Situ Instruments and Sensors
    - TX08.3.4 Environment Sensors

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System